

REMARKS

Reconsideration of this application is respectfully requested in view of the following remarks.

Entry Is Proper Under 37 C.F.R. § 1.116

Entry of this Response is proper under 37 C.F.R. § 1.116 since it: (a) places the application in condition for allowance for reasons discussed herein; (b) does not raise any new issue regarding further search and/or consideration since it amplifies issues previously discussed throughout prosecution; (c) does not present any additional claims without canceling a corresponding number of finally-rejected claims and (d) places the application in better form for appeal. The Response is necessary because it is made in reply to arguments raised in the rejection. Entry and consideration of the Response are thus respectfully requested.

Allowable Subject Matter

As a preliminary matter, Applicants appreciate the indication of allowable subject matter in claims 4, 7-8, 12-14, 16, 19-21, 23, 26-28, and 31-32 of the present application.

Summary of the Response

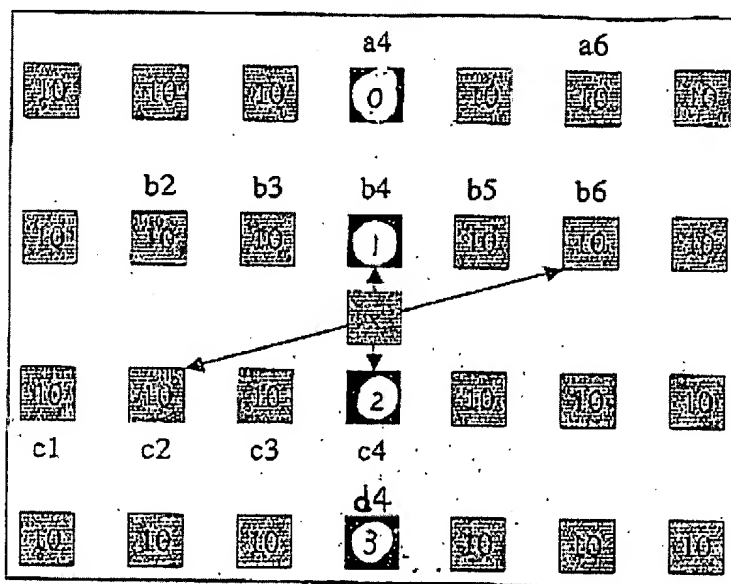
Claims 1-32 are currently pending in this application and subject to examination. In the Office Action mailed on November 16, 2004, the Examiner rejected claims 1-3, 5-6, 18, 22 and 24 under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 5,886,745 to Muraji et al. The Examiner rejected claims 9, 10, 11, 15, 17, 25, and 29-30

under 35 U.S.C. § 103(a) as being unpatentable over Muraji, et al. in view of U.S. Patent No. 6,192,158 to Abousleman. To the extent that the rejections remain applicable to the claims currently pending, the Applicants hereby traverse the rejections, as follows.

Claims 1 and 18 Recite Patentable Subject Matter

Regarding claims 1 and 18, Applicants respectfully submit that nothing in the Muraji et al., discloses or suggests at least the feature of the present invention of “finding a range where pixel data on the interpolated pixel is settable on the basis of the calculated edge component and pixel data on the first and second original pixels,” as recited in claims 1 and 18. (Emphasis added).

This feature of the present invention, as recited in claims 1 and 18, may be illustrated by the following example. For purposes of clarity and as an illustration only, Applicants use the figure reproduced below.



The figure shows an example image where a black vertical line is found in the background with the pixel level of 10. The lateral direction of this figure corresponds to the horizontal direction of the screen, while the perpendicular direction of the figure indicates the vertical direction of the screen. Each square shows a pixel and each number therein is a pixel value. The pixel value of the pixel to be interpolated is denoted by an "x."

Muraji et al. fails to disclose or suggest at least the feature of the present invention of "finding a range where pixel data on the interpolated pixel is settable on the basis of the calculated edge component and pixel data on the first and second original pixels." Upon application of the image interpolating method of Muraji et al. to the example in the figure, a correlation value in the direction of b4-c4 is represented by the following expression (1):

$$|b4-c4| + \alpha \{ |(b3-b4) - (c3-c4)| + |(a4-b4) - (b4-c4)| \} = |1-2| + \alpha \{ |(10-1) - (10-2)| + |(0-1) - (1-2)| \} = 1 + \alpha \quad (1)$$

A correlation value in the direction of b6-c2 is indicated by the following expression (2):

$$|b6-c2| + \alpha \{ |(b5-b6) - (c1-c2)| + |(a6-b6) - (b2-c2)| \} = |10-10| + \alpha \{ |(10-10) - (10-10)| + |(10-10) - (10-10)| \} = 0 \quad (2)$$

Therefore, the correlation value in the direction of b6-c2 is smaller than that in the direction of b4-c4. Consequently, the pixel value x of the interpolated pixel is calculated based on the following expression (3):

$$x = (b6+c2)/2 = (10+10)/2 = 10 \quad (3)$$

The correct value x of the interpolated pixel should be 1.5. However, when the image interpolating method of Muraji et al. is applied, the pixel value becomes 10, which may cause an unnatural image.

By contrast, upon application of the image interpolating method of the present invention to the example in the figure, an edge component E is calculated by the following expression (4):

$$E = -a_4 + b_4 + c_4 - d_4 = -0 + 1 + 2 - 3 + 0 \quad (4)$$

The minimum value of the interpolated pixel becomes $\text{Min}(b_4, c_4) + d/4 = 1.25$, while the maximum value is $\text{Max}(b_4, c_4) - d/4 = 1.75$, where $d = \text{Max}(b_4, c_4) - \text{Min}(b_4, c_4)$.

Therefore, the pixel value x of the interpolated pixel is limited to the range between 1.25 and 1.75, which is the claimed "settable range," calculated on the basis of edge component E .

A correlation value in every oblique direction is $\{ |10 - x| + |10 - x| \}$. Thus, the pixel value x where a correlation value is at a minimum is determined as the pixel value of the interpolated pixel. Specifically, the pixel value x of the interpolated pixel is not merely an average value of pixels in an oblique direction.

In this example, the correlation value is at a minimum when x is 1.75, where the settable range is between 1.25 and 1.75. Therefore, the pixel value x is determined as 1.75, which is closer to the correct value of 1.5 than is determined using the method of Muraji et al.

For at least these reasons, Applicants submit that claims 1 and 18 are allowable over the cited prior art.

Claims 9 and 25 Recite Patentable Subject Matter

With regard to the rejection of claims 9 and 25, Applicants respectfully submit that nothing in Muraji et al. or Abousleman, taken alone or in combination, discloses or suggests at least the feature of “finding a range where pixel data on the interpolated pixel is settable on the basis of the calculated edge component and pixel data on the first and second original pixels,” as recited in claims 9 and 25. (Emphasis added). Applicants submit that Muraji et al. fails to disclose or suggest this feature for at least the reasons stated above with respect to claims 1 and 18. Abousleman fails to correct this deficiency in Muraji et al.

For at least these reasons, Applicants submit that claims 9 and 25 are allowable over the cited prior art.

Claims 2-3, 5-6, 10-11, 15, 17-18, 22, 24 and 29-30 Recite Patentable Subject Matter

Claims 2-3, 5-6, 10-11, 15, 17-18, 22, 24 and 29-30 each depend from one of allowable claims 1, 9, 18 and 25, and, therefore, each of these claims incorporates each and every limitation recited within claims 1, 9, 18 and 25. It is respectfully submitted that these claims are allowable at least for the same reasons as claims 1, 9, 18 and 25.

Claims 4, 7-8, 12-14, 16, 19-21, 23, 26-28, and 31-32 Recite Patentable Subject Matter

As the Examiner indicated in the Office Action, claims 4, 7-8, 12-14, 16, 19-21, 23, 26-28, and 31-32 contain allowable subject matter.

Conclusion

For all of the above reasons, it is respectfully submitted that the claims now pending patentably distinguish the present invention from the cited references. Accordingly, reconsideration and withdrawal of the outstanding rejections and an issuance of a Notice of Allowance are earnestly solicited.

Should the Examiner determine that any further action is necessary to place this application into better form, the Examiner is encouraged to telephone the undersigned representative at the number listed below.

In the event this paper is not considered to be timely filed, the Applicants hereby petition for an appropriate extension of time. The Commissioner is hereby authorized to charge any fee deficiency or credit any overpayment associated with this communication to Deposit Account No. 01-2300, referring to client-matter number 107314-00020.

Respectfully submitted,

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Enclosures: Notice of Appeal

Petition for Extension of Time (3 months)

JH:ksm